

DESCRIPTION OF A NEW AUSTRALIAN RAPHIGNATHOID MITE, WITH REMARKS
ON THE CLASSIFICATION OF THE TROMBIDIFORMES (ACARINA).

By R. V. SOUTHCOTT.

(Two Text-figures.)

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Synopsis.

A new Australian Raphignathoid mite, *Camerobia australis*, n. gen., n. sp., is described, from Queensland and South Australia, from underneath Eucalypt bark. This mite has its mouthparts modified to a camerostome, the gnathosoma being a hinged eversible structure rotating underneath the propodosoma. The movable chelae are styliform, but comparatively short. The palpi are of 5 segments, rather slight, and the palpal tarsus does not form a "thumb" to the palpal tibia. Palpal tibia without claw. The genus is placed in a new family, Camerobiidae.

The relationships of the superfamilies Tetranychoida and Raphignathoidea of the Trombidiformes are discussed. The Raphignathoidea Grandjean 1944 is defined, and is considered as consisting of the families Raphignathidae Kramer 1877, Camerobiidae, n. fam., and Neophyllobiidae, n. fam. Neophyllobiidae, n. fam., is erected for *Neophyllobius* Berlese 1886. The relationships between these are discussed, and a key is submitted.

INTRODUCTION.

A new Australian Trombidiform mite is described from specimens collected on a small number of occasions, mainly or entirely from under the bark of *Eucalyptus* spp., in Queensland and South Australia. Superficially the mite has affinities with either the Raphignathoidea or the Tetranychoida. A study of the mite and these groups indicates that the species should be placed in the Raphignathoidea, but is clearly new in the possession of a camerostome. A description follows.

CAMEROBIA, n. gen.

Definition: With the mouthparts modified to a camerostome. The gnathosoma a hinged eversible structure lying beneath the propodosoma; in eversion with the palpi directed forwards, and in retraction with the palpi directed posteriorly, and folding into the camerostome. Palpi rather slight, of 5 segments. Palpal tibia without claw, and palp without thumb-complex. Movable chelae styliform, short. No dorsal shields to idiosoma. Eyes two on each side. Dorsal setae expanded. Perineum placed posteriorly on ventral surface. All legs with coxae and 5 movable segments. Tarsal claws falciform, tarsus with a well-developed pulvillus.

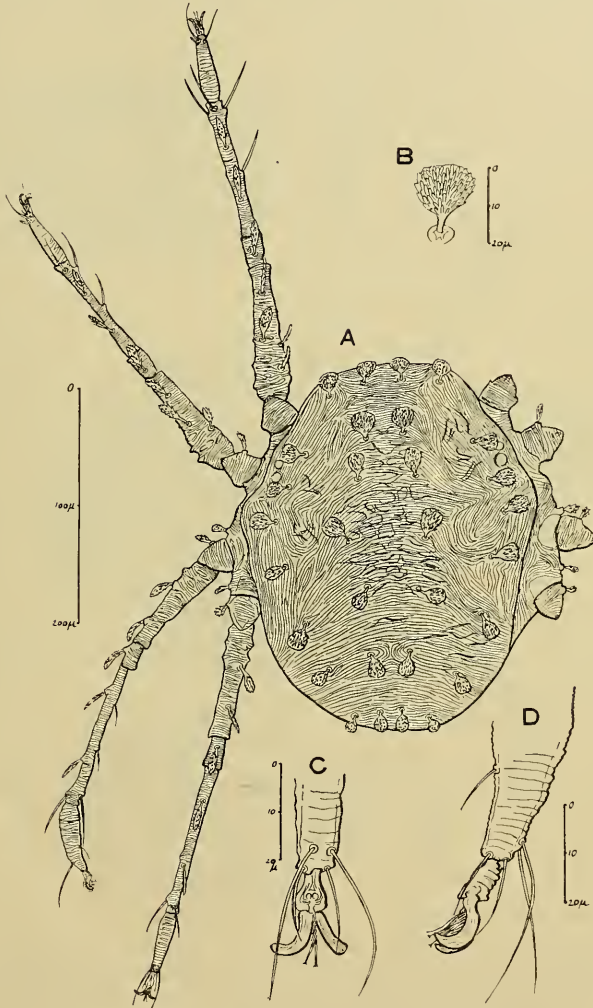
Genotype, Camerobia australis, n. sp.

CAMEROBIA AUSTRALIS, n. gen., n. sp. Text-figs. 1, 2.

Description of Adult (Text-figs. 1, 2) (mostly from Type specimen ACC 329; other specimens compared and used as indicated in text): Colour in life red. Body roughly ellipsoid dorsally, flattened ventrally. Body (idiosoma) 295 μ long by 275 μ wide at the widest point (the "shoulders" between the levels of the first and second pairs of coxae). The integument of the body is everywhere striate. Eyes two on each side, at the edge of the propodosoma, at the level of the second coxae. The anterior eye nearly circular, 9 μ across, placed slightly medial to the posterior eye, which is larger, 13 μ long, with its medial side slightly flattened. The dorsum of the body carries no sign of a scutum or

crista metopica. In the central part of the dorsum, as indicated in Text-fig. 1, A, underlying the cuticular striations is a reticular arrangement of chitin which presumably serves to strengthen that part of the animal. The dorsal setae are palmate or fanlike, with numerous small radiating projections dorsally; setae 18–25 μ long by 12–20 μ wide.

The ventral surface of the body is rather flattened, and is striate as figured. The perineum is situated at the posterior part of the ventral surface (hysterosomal, i.e.),

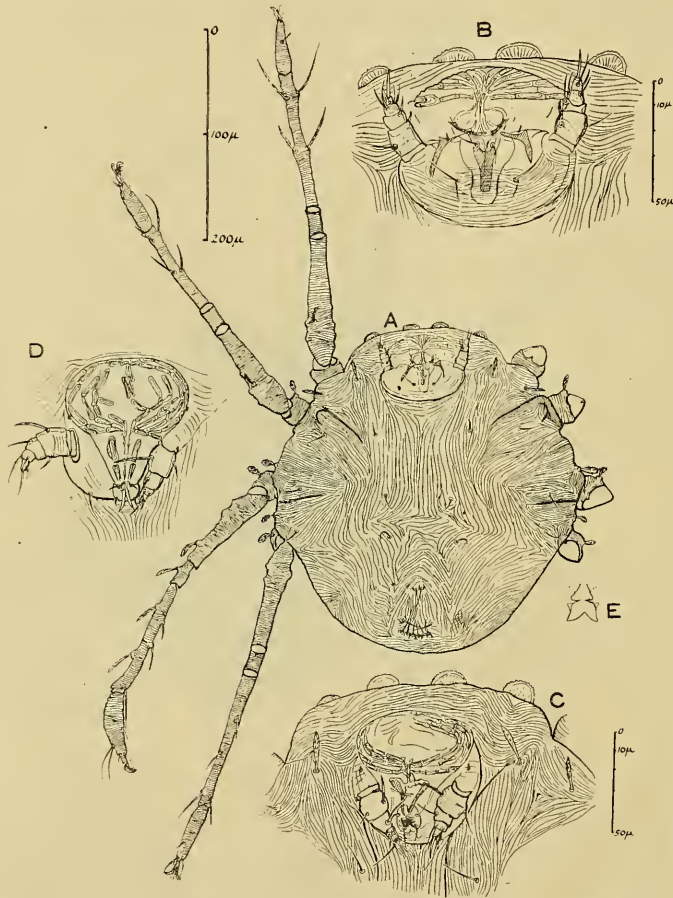


Text-fig. 1.—*Camerobia australis*, n. gen., n. sp. Adult: A, Dorsal view; B, Dorsal seta; C, Tarsus IV, from above (left); D, Tarsus III, posterior (= medial) surface (right). All figures from type specimen ACC 329; to nearest scale.

the genital and anal apertures being contiguous. A pair of anterior genital spines 21 μ long is situated at the anterior end of the genital aperture. A pair of similar posterior genital spines is placed rather more laterally at the posterior end of the genital aperture. Behind the anus is a transverse row of 4 anal spines, 18–20 μ long. Within the body, above the genital aperture, is a lightly chitinized genital apparatus, with a "cloven hoof" outline (Text-fig. 2, E). No penis is visible for certain in any of the 4 specimens. The "cloven hoof" structure is present in each of the 4 specimens. (It corresponds to

the "cup-shaped invagination with stiffened walls (plate 10, figure 46)" . . . "on the dorsal surface of the seminal vesicle" which Blauvelt (1945, page 31) describes in *Tetranychus telarius* Linn. The four specimens of *C. australis* available are therefore possibly male.)

The coxae of the legs are not in the holotype specimen sharply demarcated from the remainder of the ventral surface of the body. Narrow epimera separate coxa I from II, and III from IV. The coxae can, however, be made out by the character and flow of the cuticular striations. The striations of the coxal areas are weaker and finer than



Text-fig. 2.—*Camerobia australis*, n. gen., n. sp. Adult: A, Ventral view; B, Ventral view of mouthparts with the gnathosoma everted; C, Ventral view of mouthparts with the gnathosoma retracted within the camerostome, with the palpi pointing posteriorly; D, Same from another specimen but with the chelicerae protruding; E, Outline of chitinized internal genital structure of "cloven hoof" shape, placed level with its position within the hysterosoma, to scale of A. A, B, D from type specimen ACC 329; C from paratype ACC 330; E from paratype ACC 332. To scales indicated, A, E to same scale; B, C, D to same scale.

those of the body (this point is not brought out very strongly in Text-fig. 2, A), and more closely set. In long-mounted specimens the coxae stand out clearly, as in these the fine coxal striations are difficult to see. The distinction, however, between the two types of striations is not absolute, as in places there is some intergrading and intermingling. The four coxae are practically contiguous along each side of the idiosoma, as coxa II and coxa III are separated by only a narrow space involving 4-5 of the normal idiosomal striations. In the region of coxa I are two setae, which are clearly the

anterior and posterior coxal setae. The anterior coxal seta is clavate, spindle-shaped, spiculate with sharp strong projections, and is 22μ long by 4μ wide. The posterior seta of coxa I is similar, but rather more slender, 20μ long by 3μ wide. Coxa II bears a spiniform seta 20μ long; coxa III bears a similar seta 20μ long; IV similarly, 18μ long.

The ventral surface of the body carries 3 pairs of spiniform setae: a pair of sternal setae, curved, 19μ long, at the level of coxae I and II; an anterior metapodosomal pair, placed centrally, at the level of coxa III, 21μ long; a posterior metapodosomal pair at the level of coxa IV, but well ahead of the perineum, 14μ long.

The legs are rather thin. Besides the coxa, each leg has 5 (movable) segments. The chaetotaxy of the legs is as figured. The proximal setae of the legs tend to be clavate, whereas the distal tend to be spiniform. Tarsus I and II (but not III or IV) each carry distally and dorsally a single short sensory peg or nail, indistinctly solenoidal (striate), 8μ long, and with a rounded distal end and a slightly constricted base. Genu I and II each carry a short microsensory tack-like seta (famulus or "e" of Grandjean). The striations of the legs tend to flow around the bosses, which are most marked in the proximal part of the femur, where they form "lenses" among the striations. Each tarsus carries a pair of strong falciform claws. Between the claws is a pulvillus of two brush-like groups of vibrissae with gathered ends, terminating in little cup-like discs (see Text-fig. 1, C, D). Tarsus I is 54μ long by 15μ high, exclusive of claws and pretarsus (onychium); II similarly 53μ long, III 55μ , IV 59μ . Metatarsus I 118μ long, II 96μ , III 118μ , IV 132μ .

The gnathosoma is considerably modified, to a camerostome lying beneath the propodosoma, at the level of the anterior part of the first pair of coxae; it is invisible from above. The gnathosoma is a hinged eversible structure fitting into the camerostomal cavity. This is best understood by reference to Text-fig. 2, A, B, C, D. In the retracted position (Text-fig. 2, C, D) the palpi point posteriorly, and the rostrum with its chelicerae lies between the converging palpi. On eversion the palpi and chelicerae point anteriorly, and the palpi diverge.

The palpi are weak, of 5 segments, totalling 30μ long (exclusive of the terminal setae). The palpal tarsus does not form a "thumb" to the penultimate segment (tibia). Palpal femur, genu, tibia, tarsus with 2, 1, 2, 3 setae respectively. The setae are linear-lanceolate, spiniform or blade-like, except that the internal femoral seta (see Text-fig. 2, B for positions) has adpressed bractate ciliations. The palpal tarsus has a terminal seta, curved, swordlike, 10μ long.

With the gnathosoma everted a pair of spiniform hypostomal setae, 9μ long, can be seen at the centre of the gnathosoma. A pair of basal setae (i.e. of the basis capituli) is present more posteriorly, 20μ long, with their bases 21μ apart (Text-fig. 2, B). With the palpi retracted a pair of short pegs, 4μ long, can be seen, arising anterior to the palpal coxae, and level with the anterior coxal setae of the legs. These are shown best in Text-fig. 2, C, D. With the palpi everted these pegs are difficult to identify, but they are then probably in a position anterior to the basal seta on each side, and level with the proximal end of the palpal femur (Text-fig. 2, B).

The anterior cuticular part of the gnathosoma is a rounded bladder-like structure, carrying a group of peculiar radiating striations (Text-fig. 2, B, C, D), of unusual appearance, appearing to consist of a number of jointed segments, resembling fungal hyphae (which of course they are not). No stylophore can be seen to the gnathosoma, nor is there a mandibular plate apparent (as McGregor (1950) describes in *Neophyllobius*).

The chelicerae (movable chelae) are in most specimens difficult to identify, but in one paratype, figured in Text-fig. 2, D, they are clearly visible, slightly exerted, and are styliform, rather short. At the tip of the rostrum, seen clearly with the gnathosoma retracted, is a rounded structure with two pairs of short spiniform curved setae, possibly a hypostomal feeding lip (Text-fig. 2, C, D), similar possibly to that of the Erythraeidae in the larval stage (Trombidiformes: Erythraeoidea).

Localities.

Queensland: Type specimen, ACC 329, from under bark of *Eucalyptus* sp., at Kaban, Atherton Tableland, 24th August, 1944, Map Reference Palmerston 1:63,360 270981; Paratype specimen ACC 330 from same site and date; Paratype ACC 332 from Grovely, near Brisbane, 25th August, 1945, probably from similar habitat.

South Australia: Glen Osmond, under bark of *Eucalyptus camaldulensis*, 17th March, 1937, Paratype specimen ACC 331.

(All specimens collected by writer; in writer's collection.)

THE AFFINITIES OF THE GENUS *CAMEROBIA*, WITH REMARKS ON THE CLASSIFICATION OF THE TROMBIDIFORMES.

As indicated above, the general appearance of this mite, together with the observation that the chelicerae are styliform, suggests that it is related to, e.g., the well-known families Tetranychidae *Donnadieu* 1875 and Raphignathidae *Kramer* 1877, there being, for example, a strong superficial resemblance to the genus *Neophyllobius* *Berlese* 1886. It is, however, only of recent years that the relations between these forms have begun to be clarified. In 1944 *Grandjean* set up the superfamily Raphignathoidea for the families Raphignathidae *Kramer* 1877, Stigmaeidae *Oudemans* 1931 and Caligonellidae *Grandjean* 1944, recognizing that these formed a distinct group. It was not until the work of *McGregor* (1950) that *Neophyllobius* was excluded from the Tetranychidae, this being the last genus to be excluded, as *Baker* and *Pritchard* (1953) have pointed out. *McGregor's* morphological study was supported by the observation of *R. J. Pence* (in *McGregor*, 1950) that *Neophyllobius* was predaceous. *Baker* and *Pritchard* (*loc. cit.*) set up the superfamily Tetranychoidae *Baker* and *Pritchard* 1953 for a number of phytophagous mites, linked by morphological characters, these being the families Tetranychidae *Donnadieu* 1875, Linotetranychidae *Baker* and *Pritchard* 1953, Tuckerellidae *Baker* and *Pritchard* 1953 and Phytoptipalpidae *Ewing* 1922 (this last family being considered as including the Pseudoleptidae *Oudemans* 1928, Trichadenidae *Oudemans* 1938 and Tenuipalpidae *Sayed* 1950).

Baker and *Pritchard* (1953) proposed the following definition of the Tetranychoidae (summarized): Chelicerae very long, needlelike, strongly recurved proximally, set in an eversible sac, the stylophore. Feeding on higher, living, plants. *Baker* and *Wharton* (1952), in their Textbook of Acarology, generally did not discuss the superfamilies of the Trombidiformes, but kept the family Raphignathidae in a broad sense, justifying the fusion of this family with the Stigmaeidae and Caligonellidae with the comment "The discovery of two genera with the peritremes in the cheliceral bases but with large palpal claws and terminal anus has led to combining these three families, since they now grade into one another . . .".

The justification for the retention of the superfamily Raphignathoidea lies in the fact that, like the Tetranychoidae, its members constitute a distinct group in the Trombidiformes. *Grandjean* (1944) did not propose a formal definition of his superfamily Raphignathoidea, nor does any subsequent author up to the present appear to have done so. With the definition of the Tetranychoidae above in mind (the nearest superfamily in the Trombidiformes) we may submit the following:

RAPHIGNATHOIDEA *Grandjean*, 1944.

Definition: Chelicerae needlelike, of only moderate length or short. Stylophore absent. Tarsi of legs with pulvilli, which may be elaborate or comparatively simple. Predaceous.

Returning to *Camerobia*, it is observed that although the complete gnathosoma is eversible, there is no eversible sac attached only to the movable chela. The movable chelae are in fact difficult to identify as such in most specimens, and it was not until one specimen with partly extruded chelae was observed that the writer was sure of their identity (*see* Text-fig. 2, D). On morphological grounds therefore the genus should be placed in the Raphignathoidea. There are, however, significant differences from the

family Raphignathidae, using this term as accepted by Baker and Wharton (1952). These authors state that all genera of the family have a small to large palpal tibial claw. In some genera the palpal tarsus forms a "thumb" to the palpal tibia, as occurs also in the Tetranychoidae. Baker and Wharton (*loc. cit.*) included the genus *Neophyllobius* in the Raphignathidae, despite the fact that it lacks a tibial claw, as McGregor (1950) had shown. Both *Camerobia* and *Neophyllobius* stand apart from the other genera allotted to the Raphignathidae, both in the above character, and in the lack of dorsal body shields. The principal difference between *Camerobia* and *Neophyllobius* lies in the former's possession of a camerostome.

Modification of the mouthparts is seen in various groups in the Acarina, and often appears to be a response to a specialized feeding habit. Thus the families Myobiidae Mégnin 1877, Ophioptidae Southcott 1956 and Speleognathidae Womersley 1936 may be cited as examples. The Myobiidae are well known as specialized feeders upon the hairs (and possibly other substances) of certain mammals and the feathers of birds, with reduced palpi. The Ophioptidae, which are external parasites of certain snakes, show other modification of the palpi (Southcott, 1956). The method of feeding of the latter is unknown, but presumably the styliform chelicerae pierce the skin of the host and the mite feeds on tissue fluids from the host. In the Speleognathidae a further reduction of the palpi is seen. This family was erected by Womersley (1936) for *Speleognathus australis*, a species captured originally by the present writer running freely over the surface of water in cattle (and horse) troughs at Glen Osmond, South Australia, and observed by the writer over 1934-1941. Since that time other members of the family have been taken in the mucus-lined respiratory passages of birds and other vertebrates in various parts of the world. (Womersley's statement (1936, 1953) that the specimens were captured by myself from moss is in error; unfortunately it has been repeated by a number of other writers.) Although the method of feeding of the Speleognathidae is not known, it is possible that the family (and the probably related genus *Riccardoella*) are mucus feeders.

The above examples indicate that considerable variations may occur in the mouthparts within the Trombidiformes. In various places within the Acarina a camerostome may be seen—e.g. within the Spelaerhynchidae (Mesostigmata), the Uropodina and the Cryptostigmata (*see* Baker and Wharton, 1952). Generally speaking the presence of a camerostome may be considered as worthy of family status, possibly more.

It is on the above considerations that the writer considers that the genera *Camerobia* nov. and *Neophyllobius* Berlese 1886 should be separated by family status from the Raphignathidae and from each other. The following are therefore proposed:

CAMEROBIIDAE, n. fam.

Definition: Raphignathoid mites with the mouthparts modified to a camerostome, the eversible gnathosoma (capitulum) rotating around a transverse axis within the camerostome. Palpi simple, of five segments, without tibial claw, and the palpal tarsus does not form a "thumb" to the palpal tibia. No dorsal shields to body. Tarsal claws with a pulvillus. Type genus, *Camerobia* nov.

NEOPHYLLOBIIDAE, n. fam.

Definition: Raphignathoid mites, with the mouthparts placed anteriorly on the body, without camerostome, and with the palpus without tibial claw or thumb-complex. No dorsal shields to body. Tarsal claws with a pulvillus.

As at present, therefore, the superfamily Raphignathoidea is considered as containing the families Raphignathidae, Camerobiidae and Neophyllobiidae. There is only one other family of mites which merits consideration for possible inclusion. Baker (1949) erected a family Pomerantziidae for *Pomerantzia charlesi* Baker 1949, a North American mite found in soil. In discussing this family Baker (*loc. cit.*) stated that the "presence of the three pairs of genital suckers, the large number of sensory setae on tarsus I, and the lack of pulvilli separate this new family from the closely related

Raphignathidae-Stigmaeidae-Caligonellidae complex as well as from the Pseudocheylidae, none of which has genital suckers and in all of which there is only one sensory seta on tarsus I. The first group possesses a pulvillus with tenent hairs while the tarsi of the Pseudocheylidae are variously arranged but not as above". Elsewhere in the same article Baker commented on the difficulty in the classification of the mites. He did not finally indicate whether the Pomerantziidae should, in his opinion, be classified close to the Raphignathidae or elsewhere. Although in the family key submitted by Baker and Wharton (1952) the Pomerantziidae and the Raphignathidae are included in the same caption, at present there does not appear much evidence to include the Pomerantziidae in the Raphignathoidea (the definition of which would need to be widened); it is therefore excluded at present. A key to the classification of the families of the Raphignathoidea follows.

Key to the Families of the Raphignathoidea.

1. Palpal thumb-complex present. Palpal tibia with claw. Dorsal body shields present. Anus terminal Raphignathidae Kramer 1877
 Palpal thumb-complex absent. Palpal tibia without claw. Dorsal body shields absent. Anus subterminal 2
2. Mouthparts inferior, forming a camerostome. Mandibular plate apparently absent....
 Camerobiidae nov.
 Mouthparts anterior, not included in a camerostome. Mandibular plate present.....
 Neophyllobiidae nov.

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